

### THREE-DIMENSIONAL SIMULATION OF A HOLE-COUPLED FEL OSCILLATOR\*

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The performance of a two-mirror resonator with holes for outcoupling has been studied earlier, where the FEL gain was neglected but the geometrical effect of the wiggler aperture was included in the optical calculation (1). More recently it has been studied in the limit of small FEL gain, so that a perturbation theory can be developed (2). Here we incorporate the full effect of the FEL using the simulation code 'TDA', a time-independent, three-dimensional axisymmetric code developed by Tran and Wurtele (3). The complex electric field at the end of the interaction region is propagated through the field-free region using the Fresnel-Kirchhoff integral. The influence of different mirror and hole configurations on the mode characteristics and coupling efficiency are explored, over a range of optical wavelengths. Consequences for the CDRL-FEL are presented.

\* This work was supported by the Director, Office of Energy Research, Office of Basic Energy Sciences, Materials Sciences Division, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

- (1) M. Xie and K.-J. Kim, to appear in the proceedings of the Twelfth International Free Electron Laser Conference, Paris, France (1990).
- (2) M. Xie and K.-J. Kim, these proceedings.
- (3) T.M. Tran and J.S. Wurtele, Computer Physics Comm., 54, 263 (1989).